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# Forest Insect and Disease Management

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MOUNTAIN PINE BEETLE
Project #632
Progress Report

Black Hills
National Forest

## Rocky Mountain Region

U.S. Department of Agriculture Forest Service

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## INTRODUCTION

In 1977 a 5-year project was started on the Limestone Plateau, Black Hills National Forest, to reduce beetle populations by removing infested ponderosa pine trees and to reduce residual stand susceptibility to the mountain pine beetle. In 1977-78, a major effort by the Forest was directed towards marking and harvesting currently infested ponderosa pines in 10 sale units (Fig. 1). Accomplishments through July, 1979 are presented in Table 1. Efforts will be shifted in 1980-81 to reduce the residual stand basal area in the sale units to 80 sq. ft. per acre while continuing to remove infested ponderosa pines.

TABLE 1. Summary of 1977-79 [1/] accomplishments from Project # 632, Limestone Plateau, Black Hills National Forest

| Sale Unit | Total acres | Volume (MBF) infested trees removed | | | Total volume removed (MBF) | Acres treated to 80 basal area [2/] | | | Remaining acres to be treated |
|---|---|---|---|---|---|---|---|---|---|
| | | 1977 | 1978 | 1979[1/] | | 1977 | 1978 | 1979 | |
| Clayton Draw I | 4,720 | 324.58 | 0.48 | 0 | 325.06 | 142 | 206 | 0 | 4,372 |
| Clayton DrawII | 2,079 | 597.66 | 0.01 | 0 | 597.67 | 245 | 221 | 46 | 1,567 |
| Jackass | 300 | 222.94 | 208.54 | 0 | 431.48 | 422 | 13 | 0 | 0 |
| Savoy | 976 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 976 |
| Dead Ox | 1,163 | 484.38 | 658.99 | 0 | 1,143.37 | 975 | 1,157 | 0 | 0 |
| Limestone | 1,663 | 935.00 | 872.00 | 0 | 1,807.00 | 165 | 277 | 57 | 1,164 |
| Long Draw | 2,531 | 188.00 | 0 | 0 | 188.00 | 127 | 90 | 70 | 2,244 |
| Ranger Draw | 1,395 | 0 | 7.44 | 0 | 7.44 | 414 | 1,850 | 0 | 0 |
| Timber Gulch | 2,107 | 0 | 0.01 | 0 | 0.01 | 33 | 36 | 12 | 2,026 |
| Dead Horse | 1,564 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,564 |
| Total | 18,498 | 2,752.56 | 1,747.47 | 0 | 4,500.03 | 2,523.0 | 3,850.0 | 185.0 | |

1/ Through July 1979

2/ Acre estimates based on the volume/acre cut. Many stands were re-marked and retreated in an effort to lower the BA to 80 sq ft per acre.

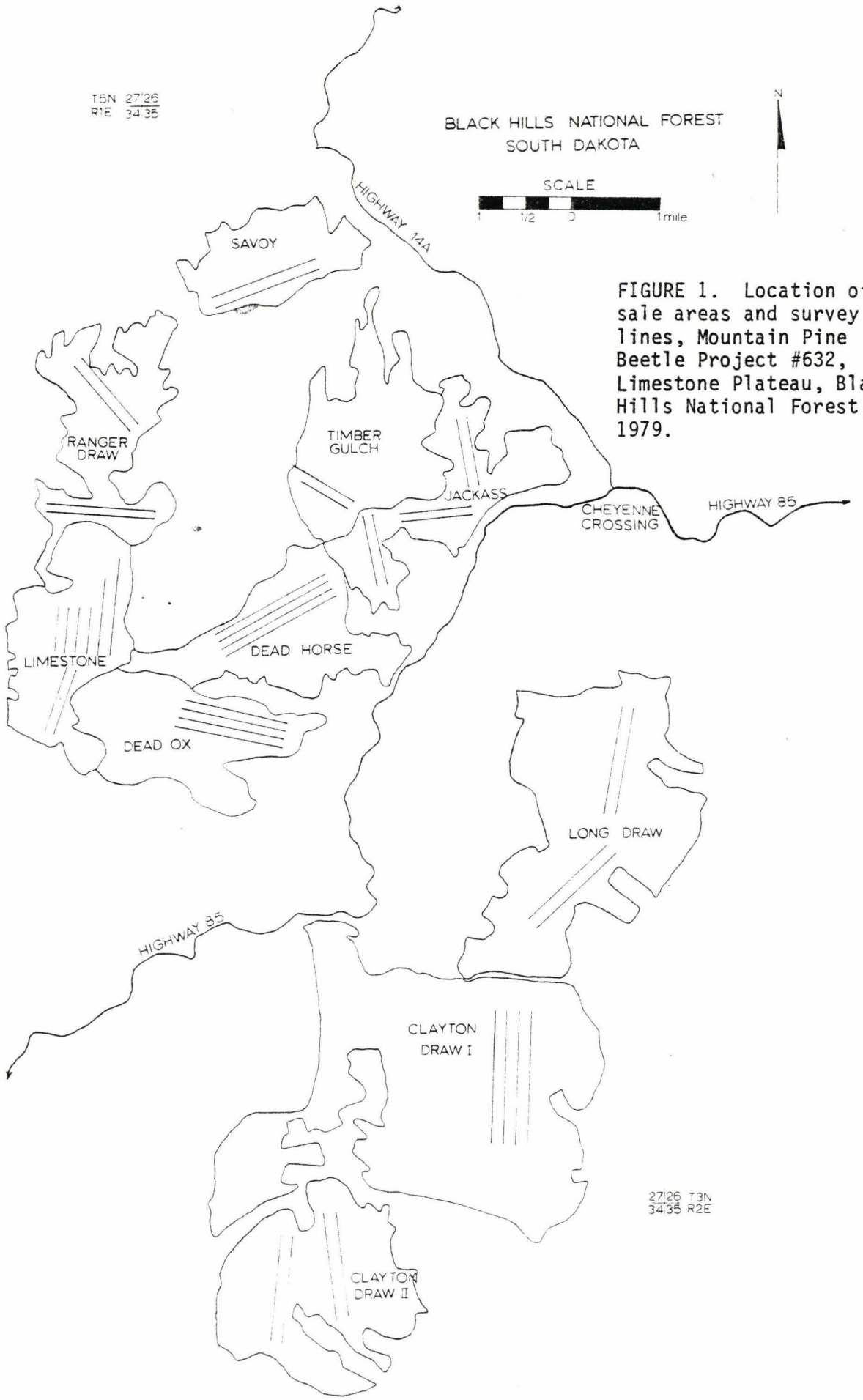


FIGURE 1. Location of sale areas and survey lines, Mountain Pine Beetle Project #632, Limestone Plateau, Black Hills National Forest, 1979.

The purpose of this progress report is to:

1. Describe current stand and Entomological conditions within the Project area.

2. Point out priority work areas to effectively accomplish the goals of the project by the end of FY 1981.

## METHODS

Both strip and variable plot cruises were conducted in each of the 10 sale units. The locations of cruise lines and variable plots are shown in Figure 1. Cruise lines were variable in length (40-120 chains), one-half chain wide, and 10 chains apart. All mountain pine beetle attacked trees were recorded by diameter (d.b.h. to the nearest 0.1 inch) and attack class:

1. New = 1979-infested

2. Old = 1978-infested

3. P.O. = 1979 Pitch-outs

Variable plots (20 BAF) were located at the beginning and end of each cruise line and at 20-chain intervals along cruise lines. All living uninfested ponderosa pine, birch, aspen and spruce trees greater than 5 inches d.b.h. were counted and diameters (d.b.h. to the nearest 0.1 inch) measured.

## RESULTS

A summary of the strip cruise data is given in Table 2. The attack ratios indicate that the mountain pine beetle is decreasing in all sale units except Ranger Draw and Timber Gulch. These two units show a static to increasing infestation. Since logging prior to this evaluation included removal of old, 1978-infested ponderosa pines, the actual ratios may be even lower than indicated in Table 2. The overall new to old attack ratio for the Limestone Plateau is 0.42 indicating a decreasing infestation.

Table 2. Summary by Sale Unit of 1979 Strip Cruise Data on Beetle-attacked Ponderosa Pine on the Limestone Plateau, Black Hills National Forest.

| Sale Unit | Total chains of line | Acres Surveyed | Ave. diam. (inches) attached trees by attack class [1] | | | Total no. attacked trees by attack class | | | New infested trees/ acre | Attack Ratio New/Old |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | New | Old | P.O. | New | Old | P.O. | | |
| Clayton DrawI | 480 | 24 | 12.5 | 8.5 | | 2 | 5 | | 0.08 | 0.40 |
| Clayton DrawII | 320 | 16 | | 7.6 | | | 1 | | | |
| Jackass | 240 | 12 | | | 12.1 | | | 3 | | |
| Savoy | 220 | 11 | 12.1 | 14.3 | 12.3 | 10 | 30 | 6 | 0.91 | 0.33 |
| Dead Ox | 400 | 20 | 13.2 | 12.4 | 9.3 | 1 | 2 | 9 | 0.05 | 0.50 |
| Limestone | 420 | 21 | 9.9 | 8.6 | 9.9 | 6 | 42 | 24 | 0.29 | 0.14 |
| Long Draw | 320 | 16 | | 11.4 | 9.4 | | 5 | 2 | | |
| Ranger Draw | 320 | 16 | 10.3 | 10.1 | 11.0 | 7 | 6 | 13 | 0.44 | 1.17 |
| Timber Gulch | 260 | 13 | 10.3 | 10.8 | 14.0 | 25 | 20 | 12 | 1.92 | 1.25 |
| Dead Horse | 480 | 24 | | 10.1 | 14.0 | | 11 | 3 | | |
| Total | 3,460 | 173 | | | | 51 | 122 | 72 | | |
| Average [2] | | | 11.4 ± .6 | 10.4 ± .7 | 11.5 ± .7 | | | | 0.29 | 0.42 |

[1] New = 1979-infested, OLD = 1978-infested, P.O. = 1979-pitchout

[2] ± SE

The estimated number of new infested trees per acre is 0.29 over the Plateau. The Savoy and Timber Gulch units contain the greater portion of the newly infested trees per acre.

The general decrease of the mountain pine beetle infestation on the Plateau can be attributed to three factors:

1. Stepped-up efforts at removing currently infested ponderosa pines.

2. A general increase in tree vigor due to a reduction in residual stand basal area.

3. Favorable moisture conditions for tree growth throughout the summer months of 1979.

The influence of factors 2 and 3 can be verified in that nearly 60% of the trees attacked in 1979 were able to pitchout the beetle. Which of these two factors, played a major role in the percentage of pitchouts was not determined.

A summary of the variable plot data is given in Table 3. Average residual stand basal areas ranged from 57.0 $\pm$ 7.6 sq ft/ac in the Clayton Draw II unit to 133.0 $\pm$ 14.2 sq ft/ac in the Timber Gulch unit. The average residual stand basal area over the survey area is estimated to be 88.7 $\pm$ 6.9 sq ft/ac. In all units ponderosa pine is the major tree species contributing to the total basal area. Basal area information given here does not take into consideration trees less than 5 inches d.b.h. Only trees normally considered to be susceptible to mountain pine beetle attack were recorded. Therefore, actual basal areas will run somewhat higher than indicated. In most cases, where plots contained tree species other than ponderosa pine, these species occurred in pure stands or were dominant over ponderosa pine.

Basal areas within each sale unit were highly variable. The factors contributing to this variability were:

1. Seven (7) percent of the plots contain no ponderosa pine, due to removal of beetle infested trees.

2. Thirty (30) percent of the plots contained 40 basal area or less in all species.

3. Thirty-three (33) percent of the plots were in excess of 120 basal area in all species.

Table 3. Summary by Sale Unit of 1979 variable plot data from the Limestone Plateau, Black Hills National Forest.

| Sale Unit | # var. plots | Ave. diam. (inches) of the residual stand by species [2] | | | | Ave. basal area (sq ft/ac) of the residual stand by species | | | | Ave. [1] basal area |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PP | BIR | ASP | SP | PP [1] | BIR | ASP | SP | |
| Clayton Draw I | 28 | 14.7 | | 8.1 | 10.7 | 51.4 ± 8.8 | | 5.0 | 37.1 | 93.5 ± 8.9 |
| Clayton Draw II | 20 | 14.0 | | 8.2 | 10.8 | 49.0 ± 8.3 | | 3.0 | 5.0 | 57.0 ± 7.6 |
| Jackass | 16 | 13.4 | 5.7 | 7.3 | 13.6 | 68.8 ± 15.7 | 5.0 | 5.0 | 21.3 | 100.1 ± 12.5 |
| Savoy | 13 | 14.9 | | | 10.7 | 75.4 ± 13.0 | | | 3.1 | 78.5 ± 12.3 |
| Dead Ox | 24 | 13.3 | 6.6 | 7.5 | 21.1 | 61.7 ± 8.4 | 3.3 | 5.8 | 0.8 | 71.6 ± 8.5 |
| Limestone | 29 | 12.3 | 8.8 | 8.0 | | 64.8 ± 10.8 | 0.7 | 7.6 | | 73.1 ± 11.2 |
| Long Draw | 20 | 11.3 | | 7.6 | 11.3 | 55.0 ± 15.3 | | 3.0 | 22.0 | 80.0 ± 13.3 |
| Ranger Draw | 20 | 12.6 | | 8.9 | | 85.0 ± 11.4 | | 4.0 | | 89.0 ± 11.6 |
| Timber Gulch | 17 | 11.8 | | | 12.0 | 131.8 ± 13.8 | | | 1.2 | 133.0 ± 14.2 |
| Dead Horse | 28 | 12.8 | 6.1 | 7.5 | 11.8 | 94.3 ± 13.2 | 0.7 | 5.7 | 10.0 | 110.7 ± 11.9 |
| Total | 215 | 777 | 10 | 47 | 114 | | | | | |
| Average [1] | | 13.1 ± .4 | 6.8 ± .7 | 8.0 ± .2 | 12.8 ± 1.2 | 73.7 ± 7.9 | 2.4 ± 1.1 | 4.9 ± .6 | 12.6 ± 4.6 | 88.7 ± 6.9 |

[1] $\bar{x} \pm SE$

[2] PP = ponderosa pine, BIR = Birch, ASP = Aspen, SP = Spruce

The last of these three factors provides an indication that average basal area is a poor indicator of mountain pine beetle stand susceptibility. Sale areas will remain susceptible to mountain pine beetle, regardless of their average basal area, if a larger percentage of the stands in the area are high in basal area, ie. in excess of 120 sq ft/ac.

The average residual ponderosa pine basal area is estimated to be 73.7 $\pm$ 7.9 sq ft/ac with a residual stem diameter of 13.1 $\pm$ 0.4 inches (d.b.h.). This average residual stem diameter is significantly greater ($P < .05$) than the average stem diameter of trees in all three attack classes.

## DISCUSSION

Timber harvesting in 1980-81 should be directed towards lowering the residual stand basal area to 80 sq ft per acre, reducing variability in residual stand basal area and, continued removal of all currently infested ponderosa pines. Sale units needing particular attention to basal area reduction are:

1. Timber Gulch
2. Dead Horse
3. Ranger Draw

Sale units needing attention in removal of infested ponderosa pines are:

1. Savoy - entire unit

2. Limestone - between roads 134 and 734 and at the junction of roads 733 and 734

3. Timber Gulch - entire unit

4. Ranger Draw - entire unit

Current optical bar resource photography (1979) can be used to determine the exact locations of mountain pine beetle infestation and stands of excess basal area in these units.

In general, pondersoa pine stands on the Limestone Plateau are still susceptible to mountain pine beetle attack. Inoperable areas along Spearfish and Little Spearfish Creeks will continue to be a source for reinvasion of the Plateau by the mountain pine

beetle. Therefore, every effort should be made to harvest beetle infested trees and reduce the basal area in as many operable stands on the Plateau as possible. Also, infested stands west of road 134 will provide an additional source of mountain pine beetle reinvasion. Sales should be established in these stands to protect the current investment in timber management throughout the Plateau area.

Evaluations to determine the variables involved in tree and stand susceptibility are being conducted throughout the northern Black Hills by FIDM. These variables include:

1. The effects of diameter, tree height and crown ratio on tree susceptibility.

2. The effects of basal area, growing stock level, site quality, tree species composition and weather on stand susceptibility.

An intensive re-evaluation of these sale areas will be conducted upon completion of the project in the fall of 1981. All current information gained on tree and stand susceptibility will be used to provide alternative recommendations on a stand basis.